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hundreds more lawyers and doctors than can obtain a decent living.

The remedy for all this must lie largely in technical education. Teach a trade and the practical application of principles, and inculcate the lesson that no calling is dignified in itself, but it becomes what those who follow it choose to make it. We believe that Professor Thompson's essay is a positive contribution to our knowledge of this subject, and therefore should be carefully studied by all who are interested in education.

NICHOLAS MURRAY BUTLER.

THE CHARACTERS OF CHILDREN AS EVIDENCED BY THEIR POWERS OF OBSERVATION.

THE study of the powers of observation in children has been seldom attempted in a systematic way; and yet, with the tendencies and aims of modern education, there can scarcely be any subject from which might be expected more fruitful results. Professor Farlow, in his recent address before the Society of naturalists, has asserted that the schools, in the last six or seven years, have made no perceptible progress in developing these powers, and that, so far as elementary training is concerned, we are about where we were ten years ago. Furthermore, in his own experience, he finds that the tendency of education, in the lower schools at least, is to impair, rather than to sharpen, the natural powers in this respect. Considering how important an element of successful work, in most careers, this faculty is, one cannot fail to appreciate the value of experiments that may throw light upon remediable mental defects, or upon mental excellences, in childhood.

At the suggestion of Mr. Francis Galton, Mrs. Sophia Bryant, D.Sc., has recently¹ attempted a series of such experiments, the results of which, though subject to fallacies, will point out a fruitful line of investigation.

Her method was the analysis of the characteristics evinced in the description of given objects by a number of school-children, all of whom were of the same age (thirteen years), and unknown to her. For this purpose they were allowed to remain for about ten minutes in a room which they did not know, and were then required to write a description of it. The one first described was a schoolroom, having certain features in common with other schoolrooms familiar to the children, but having certain others peculiar to itself, and a sufficient amount of ornament, in pic-

tures and otherwise, to redeem it from being quite prosaic. The results of her analyses were afterwards compared with the characteristics as given by the children's teachers; from which comparisons, in many cases, striking agreements were found. Of course, in such experiments, as the author rightly says, only repeated and varied trials can eliminate the chances of error; and much less weight should be attached to negative than to positive results. The points thus brought out were as follows:—

1°. In the perception of an object a logical distinction is made between the sense-impression and the apprehension of it by the mind, as between the passive and active factors of perception. Apprehension is essentially the bringing of the new into relation with the old, and thus interpreting the new by means of the old.

In the ratio of these two factors of perception to each other, there were found signs of great variety. Impressions were sometimes numerous and faithful where the power of giving them a meaning, and thus perceiving them fully, was clearly very slight, or at least inoperative. In such cases the perception was what would be ordinarily called unintelligent. In other cases the impressions either made, or at any rate dwelt upon, were fewer, but the apprehension of them was very complete. This completeness of apprehension or understanding occasionally passed beyond the limits of full and accurate perception into pure inference. Sometimes the inference was correct, and that not by chance, since it had the marks of having been cautiously conducted. Such little phrases as 'I suppose,' or 'it is likely,' are tell-tales here, as marking off the cautious from the reckless thinker. This latter person was betrayed also by a very unmistakable hastiness of inference, which in the bad cases degenerated into actual false perception. For instance: the name 'C. W.' in the corner of a picture was reported as 'M. W.,' this being the name of a girl in school whom the young observer knew very well.

It was found, as indeed might naturally be expected, that the false perceivers were nearly always ready apprehenders, who, apparently digressing into actual inference, inferred carelessly, and projected their false inferences into false perceptions. The carelessness of such inference is of a very simple character: the impressions to the test of which the inference should be brought are there, and it is not brought to the test. This argues absence of the impulse to criticise, which is the basis of accurate habits of thought. Feebleness of the impressions is, it must be admitted, a negative cause for the false perceptions, since the test is thus kept in the background; but it is only

¹ *Journ. anthropol. inst. of Great Britain and Ireland*, xv. 338, February, 1866.

a negative cause, since, if the critical impulse were really strong, the inference would be challenged at least, even if it could not be corrected. In judgments, however, as to character-tests, it would be necessary to estimate this negative cause as otherwise indicated, and allow for it before deciding on the degree of the critical defect.

2°. In the second place, differences were observed in the degree of orderliness with which perceptions are marshalled, and in the general notion of order which characterizes any particular observer.

Out of twenty observers, eight gave evidence of no noticeable interest in order at all: the objects appeared to have been observed haphazard, as far as their relation to one another logically, or in place, went. On the other hand, seven descriptions were as orderly as they could well be expected to be; while to three, half marks were given, and to one two-fifths. In most of the orderly descriptions the order chosen was that of place,—the order of the inventory round the room, some starting from the door, some from the opposite point, and some from the clock in the middle. In one or two the order was logical; i.e., the order of what may be called the idea of the room, as in one paper which begins, “The first thing that strikes you are the rows of desks and girls.” In another set of papers, describing a more ornamental kind of a room, signs were found of a third kind of order, sometimes very strong,—the order, namely, of aesthetic effects; the order in space, and in idea too, being subordinated to the order in feeling for the beautiful.

3°. Great differences in color-interest were also observable, since some took pains to describe colors fully, while others took no notice of color at all, or very little. In the same way, any marked interest in form was also shown; though in the experiments under consideration no call was made upon the form-interest so strong as to test defect by the absence of response.

4°. One other characteristic, and a most important one, came out into strong relief in a few cases. This is the tendency to substitute feeling for thinking, to apprehend impressions as the minimum of idea with the maximum of emotion, which may be called, for simplicity, over-emotionalism. An over-emotional person perceives objects habitually as sources of feeling; and that is, of course, equivalent to not properly perceiving them at all. Now when, in the description of a room, a child tells you that it is very beautiful, and there are lovely curtains, and the sweetest flowers, and pretty ornaments, it may be considered an evident mark of over-emotionalism, and should, in the educational interest, recommend a whole-

some diet of ideas accordingly. The negative defect—for, after all, it is a defect—of under-emotionalism is, like all negative defects, difficult to test; but the freedom from defect reveals itself every now and then in little touches that are very subtle.

In other observations made, a picture was used as a test. The same contrasts as before were to some extent brought out in the various descriptions of the picture; but there was occasion for another set of contrasts in these cases, and these contrasts came out decidedly. To see a picture in the full sense is to understand its meaning, and in the interpretation of meaning there is abundant scope for the most varied play of imagination, whether checked by faithful observation or not. Just as the perception of an object resolves itself into the two factors of impression and apprehension, so the observation of a complex of objects resolves itself into the two factors of perception and explanation by means of appropriate fetches of the constructive imagination. Now, in some children there was found abundant and accurate perceptive detail, with something like the minimum of constructive explanation. In others the opposite extreme was manifest, explanation good, and details little dwelt upon or even described with imperfect accuracy. Between these extremes the two factors were combined in various ratios, including the ratio of equality characteristic of the well-balanced type of mind.

Again, varieties in the nature of the imaginative play, which suggested well-marked contrasts of general character, were observed. Sometimes the play of imagination was almost purely intellectual, strictly subordinated to the purpose of fetching ideas for the explanation of observations. This may be called the logical or intellectual imagination. In other cases the fetch of imagination was not so much after ideas to construe with, as after feelings to luxuriate in: the ideas are overpowered in a mass of vague associated emotion. This, if it can be called imagination at all, may be marked out as the emotional variety; and a touch of it is not, of course, out of place in describing an object like a picture, which has distinct aesthetic bearings. But most striking of all were the examples of dramatic imagination, which were not rare: here the picture is lost in the story which it is interpreted as meant to tell; the picture becomes the occasion for a departure into story-land, instead of remaining, as in the first case, the main fact, solely for the explanation of which such departures are at all allowed, and by which they are limited. Besides these marked cases, there were doubtful cases, and cases negative altogether. Sometimes, too,

the play of imagination was markedly careless, and uncontrolled by the inward critic, as compared with the good cases in which it showed itself sober and self-controlled.

As the author says, the sources of error in such observations as these are very numerous; but from repeated observations by many observers, carefully collated, these errors may be in a great measure eliminated, and substantial results arrived at, of whose practical bearing there can be little doubt.

OBSERVATIONS UPON DIGESTION IN THE HUMAN STOMACH.

DIRECT observations on digestion in the human stomach have been very seldom made, as opportunities for such cannot often occur. Those by Beaumont many years ago are familiar to every student of physiology, and, notwithstanding their lack of completeness and their many imperfections, they served a very useful purpose in explaining many of the processes whereby digestion is affected in this organ. These observations have been supplemented by others; but the results of modern physiological researches have been such, that renewed opportunities to make such direct observations must be of great value. Such a one occurred within the past year in the person of Heinrich Baud, a healthy young man twenty-eight years of age, into whose stomach, in consequence of a stricture of the oesophagus that prevented the passage of all food, a surgical opening five centimetres in length was made. The case passed into the hands of Mr. A. Herzen, the well-known physiologist, who improved the opportunity to make a series of experiments upon the digestibility of certain foods and upon the behavior of the gastric juices (*Kosmos*, 1885, ii. 1, 4). The pepsin secreted by the patient was of unusual quantity, and, what has hitherto never been observed in similar cases, or through the artificial fistulas of dogs or other animals, there was a changeable but often considerable quantity of bile present. These circumstances, however, though complicating the experiments, did not especially affect the results.

The author's methods of experimenting were as follows: a substantial meal was given to the patient at 7 o'clock in the evening, and nothing further was permitted to enter his stomach till the next morning, when experiments at 6 o'clock were begun, first upon the empty organ. After an examination of the juices therein contained, there was introduced the albumen from three hard-boiled eggs, with two to three hundred grams of water, together with three small silken nets, each containing eight small pellets of albumen, uniform

in size, and regular in shape, and which could be easily withdrawn for examination. These observations through the fistula were made hourly, and one of the nets with its contents removed.

Remarkable and unaccountable conditions were found in which the albumen remained one or even two hours in the stomach without undergoing any perceptible change, notwithstanding the presence of ferment, with which it was impregnated. In these cases the albumen pellets usually retained in their substance precisely the requisite quantity of pepsin for their solution, which, under favorable circumstances afterwards, exactly sufficed to digest them. This furnishes evidence that the pepsin does not act through simple contact alone, and that a given quantity of it can dissolve only a given quantity of albumen, and that consequently the pepsin, by the exercise of its digestive activity, loses its entire potency.

Observations directed toward the ascertainment of the time required for the stomach-juices to impregnate coagulated albumen showed that they penetrated about one millimetre during the first hour and three millimetres within the second. It was also learned that the acids were much more active than the pepsin in penetrating the substance. This last fact furnishes a new proof of the presence of a free acid in the stomach-juices. The juices, however, at such opportunities as it was possible to examine them, were sometimes found to be of a neutral reaction. But, in order to test the action of acid and ferment further, he introduced at times a quantity of soda to neutralize the acid; without, however, materially affecting the activity of the pepsin, although it appeared to somewhat diminish it. It therefore results that pepsin exerts its digestive power almost wholly independently of the acid. The reverse of this, as may be expected, was also found true, — that the acids penetrated the albumen in the absence of the pepsin, and, when the pieces of albumen were small, a sufficient quantity was absorbed to digest them.

Another series of researches was made upon the fluids of the stomach, from which it was found, that, on the mornings after fasting, the secretion usually was small, while at such times following the ingestion, during the night, of milk or any fluids containing alcohol, the secretion was greater. During the first hours of digestion the quantity held a definite relation to the volume of substances introduced, while in the fifth hour the quantity was always more abundant, about three or four hundred grams. The first secretion of the morning was in general a somewhat thick, very stringy, more or less clear fluid, which resembled the white of an egg; that obtained during the